CHAPTER 7. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

TABLE OF CONTENTS

LIST OF TABLES

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7.1 INTRODUCTION

To carry out the engineering and life-cycle cost (LCC) analyses, DOE needed to determine the cost to the customer of a baseline product and the cost of more-efficient units. By applying a multiplier called a "markup" to the manufacturers' equipment costs estimated in the engineering analysis, DOE estimated the consumer prices for baseline models and more-efficient equipment. DOE developed one set of markups for all residential cooking products.

The technical support document (TSD) for DOE's notice of proposed rulemaking (NOPR) covered conventional cooking products (i.e., cooktops and ovens), microwave ovens, and commercial clothes washers (CCW).[1] This chapter presents information and results pertaining solely to conventional cooking products and microwave ovens. The impact of more-efficient equipment on CCW markups and consumer prices will be addressed in a subsequent TSD.

7.1.1 Distribution Channels

The appropriate markups for determining the consumer equipment price depend on the type of distribution channels through which products move from manufacturers to purchasers. At each point in the distribution channel, companies mark up the price of the equipment to cover their business costs and profit margin.

DOE based the distribution channels on data from the Association of Home Appliance Manufacturers (AHAM).[2] AHAM estimates that 93 percent of residential cooking products are sold through retail outlets. Because an overwhelming majority of products are sold through retail outlets, DOE assumed that all of the residential products are purchased by consumers from retail outlets.

7.1.2 Markup Calculation Procedure

As just discussed, at each point in the distribution channel, companies mark up the price of the equipment to cover their business costs and profit margin. In financial statements, gross margin is the difference between the company revenue and the company cost of sales or cost of goods sold (*CGS*). Inputs for calculating the gross margin are all corporate costs—including overhead costs (sales, general, and administration); research and development (R&D) and interest expenses; depreciation, and taxes—and profits. In order for sales of a product to contribute positively to company cash flow, the product's markup must be greater than the corporate gross margin. Individual products may command a lower or higher markup, depending on their perceived added value and the competition they face from similar products in the market.

In developing markups for manufacturers and retailers, DOE obtained data about the revenue, *CGS*, and expenses of firms that produce and sell the products of interest. DOE's approach categorizes the expenses into two categories: labor-scaling costs (*LSC*), which are fixed labor and occupancy expenses that increase in proportion to the amount of labor required to produce or sell the product, and non-labor-scaling costs (*NLSC*), which are variable operating costs that do not scale with labor and vary in proportion to *CGS*. Together, *LSC* and *NLSC* represent the gross margin.

7.1.2.1 Approach for Manufacturer Markups

DOE uses manufacturer markups to transform a manufacturer's equipment costs into a manufacturer sales price. Using the *CGS* and gross margin, DOE calculated the manufacturer markup (MU_{MFG}) with the following equation:

$$MU_{MFG} = \frac{CGS_{MFG} + GM_{MFG}}{CGS_{MFG}}$$

where:

MU_{MFG} = Manufacturer markup,
CGS_{MFG} = Manufacturer's cost of goods sold, and
GM_{MFG} = Manufacturer's gross margin.

7.1.2.2 Approach for Retailer Markups

DOE based the retailer markups for residential cooking products on financial data from the U.S. Census Business Expenditure Survey. DOE organized the financial data into balance sheets that break down cost components incurred by firms that sell the products.[a] The key assumptions that DOE used to estimate the retailer markups using these financial data were:

1. The balance sheets faithfully represent the various average costs incurred by firms selling home appliances.

2. These costs can be divided into two categories:
   a. Costs that vary in proportion to the manufacturer sales price (variable costs); and
   b. Costs that do not vary with the manufacturer sales price (fixed costs).

3. Retailer sales prices vary in proportion to retailer costs that are included in the balance sheets.

In support of the first assumption, the balance sheets itemize firm costs into a number of expense categories, including *CGS*, operating labor and occupancy costs, and other operating

[a] The retailers to whom these financial data refer handle multiple commodity lines.

costs and profit. Although retailers tend to handle multiple commodity lines, the data provide the most accurate available indication of home appliance expenses.

Information obtained from the trade literature pertaining to the heating, ventilation, and air-conditioning (HVAC) contracting industry tends to support the second assumption. This information indicates that retailer markups should vary according to the quantity of labor and materials used to sell or distribute the equipment, with markups on labor tending to be much larger than markups on materials.[3] This information also describes markups as varying much more in relation to sales volume than in relation to other factors, including appliance efficiency. This last finding strongly suggests that labor inputs vary more with sales volume than with appliance cost or efficiency. In the discussion that follows in section 7.3, DOE assumes a division of costs between those that do not scale with the manufacturer sales price (fixed costs—labor and occupancy expenses referred to above as *LSC*), and those that do (variable costs—operating expenses and profit referred to above as *NLSC*). This division of costs led to the estimate of retailer markups described below in section 7.3.

In support of the third assumption, the retailer industries are relatively competitive, and consumer demand for residential home appliances is relatively inelastic, i.e. the demand is not expected to decrease significantly with a relatively small increase in price. The large number of household appliance stores listed by the U.S. Census Bureau in its *Statistics of U.S. Businesses* indicates the competitive nature of the market.[4] For example, there are more than 10,000 household appliance store establishments and over 5000 merchant wholesaler establishments of service equipment in the U.S.[b] Following standard economic theory, competitive firms facing inelastic demand either set prices in line with costs or quickly go out of business.[5]

Using the above assumptions, DOE developed baseline and incremental markups to transform the manufacturer sales price into a consumer equipment price. DOE used the baseline markups, which cover all of a retailer's costs (i.e., both *LSC* and *NLSC*), to determine the sales price of baseline models. The baseline markup relates the manufacturer sales price to the retailer sales price. DOE considers baseline models to be equipment sold under existing market conditions (i.e., without new energy efficiency standards). DOE calculated the baseline markup (MU_{BASE}) for retailers using the following equation:

$$MU_{BASE} = \frac{CGS_{RTL/DIST} + GM_{RTL/DIST}}{CGS_{RTL/DIST}} = \frac{CGS_{RTL/DIST} + (LSC_{RTL/DIST} + NLSC_{RTL/DIST})}{CGS_{RTL/DIST}}$$

where:

MU_{BASE} = Baseline retailer markup,
$CGS_{RTL/DIST}$ = Retailer's cost of goods sold,
$GM_{RTL/DIST}$ = Retailer's gross margin,

[b] DOE determined the number of establishments for household appliance stores based on the following North American Industry Classification System (NAICS) code and description: 443111, *Household Appliance Stores*.

$LSC_{RTL/DIST}$ = Retailer's labor-scaling costs, and
$NLSC_{RTL/DIST}$ = Retailer's non-labor-scaling costs.

Incremental markups cover only those costs that scale with a change in the manufacturer's sales price (i.e., *NLSC*). Incremental markups are coefficients that relate the change in the manufacturer sales price of higher-efficiency models to the change in the retailer sales price. DOE considers higher-efficiency models to be equipment sold under market conditions with new efficiency standards. It calculated the incremental markup (MU_{INCR}) for retailers using the following equation:

$$MU_{INCR} = \frac{CGS_{RTL/DIST} + NLSC_{RTL/DIST}}{CGS_{RTL/DIST}}$$

where:

MU_{INCR} = Incremental retailer markup,
$CGS_{RTL/DIST}$ = Retailer's cost of goods sold, and
$NLSC_{RTL/DIST}$ = Retailer's non-labor-scaling costs.

7.1.2.3 Overall Markup

The overall markup is the product of the manufacturer and retailer markups, as well as sales taxes.

DOE used the overall baseline markup to estimate the consumer equipment price of baseline models, given the manufacturer cost of the baseline models. As stated above, DOE considers baseline models to be equipment sold under existing market conditions (i.e., without new energy efficiency standards). The following equation shows how DOE used the overall baseline markup to determine the equipment price for baseline models.

$$EQP_{BASE} = COST_{MFG} \times \left(MU_{MFG} \times MU_{BASE} \times Tax_{SALES}\right) = COST_{MFG} \times MU_{OVERALL\_BASE}$$

where:

EQP_{BASE} = Consumer equipment price for baseline models,
$COST_{MFG}$ = Manufacturer cost for baseline models,
MU_{MFG} = Manufacturer markup,
MU_{BASE} = Baseline retailer markup,
Tax_{SALES} = Sales tax, and
$MU_{OVERALL\_BASE}$ = Baseline overall markup (product of manufacturer markup, baseline retailer markup, and sales tax).

Similarly, DOE used the overall incremental markup to estimate changes in the consumer equipment price, given changes in the manufacturer cost above the baseline model cost resulting from a standard to raise equipment efficiency. The total consumer equipment price for higher-

efficiency models is composed of two components: the consumer equipment price of the baseline model and the change in consumer equipment price associated with the increase in manufacturer cost to meet the new efficiency standard. The following equation shows how DOE used the overall incremental markup to determine the consumer equipment price for higher-efficiency models (i.e., models meeting new efficiency standards).

$$EQP_{STD} = COST_{MFG} \times MU_{OVERALL\_BASE} + \Delta COST_{MFG} \times \left(MU_{MFG} \times MU_{INCR} \times Tax_{SALES}\right)$$
$$= EQP_{BASE} + \Delta COST_{MFG} \times MU_{OVERALL\_INCR}$$

where:

EQP_{STD} = Consumer equipment price for models meeting new efficiency standards,
EQP_{BASE} = Consumer equipment price for baseline models,
$COST_{MFG}$ = Manufacturer cost for baseline models,
$\Delta COST_{MFG}$ = Change in manufacturer cost for higher-efficiency models,
MU_{MFG} = Manufacturer markup,
MU_{INCR} = Incremental retailer markup,
Tax_{SALES} = Sales tax,
$MU_{OVERALL\_BASE}$ = Baseline overall markup (product of manufacturer markup, baseline retailer markup, and sales tax), and
$MU_{OVERALL\_INCR}$ = Incremental overall markup (product of manufacturer markup, incremental retailer markup, and sales tax).

7.2 MANUFACTURER MARKUPS

DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10-K reports filed by four publicly-traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes residential cooking products.[6] The four manufacturers represent a nearly 50 percent market share fore core appliances. Because these companies are typically diversified, producing a range of different appliances, an industry average markup was assumed by DOE to be representative for the manufacture of each type of appliance. DOE evaluated markups for the years between 2002 and 2005, inclusive.

Table 7.2.1 lists the average corporate gross margin during the years from 2002 to 2005, and corresponding markups, for each of the four manufacturers.

Table 7.2.1 Major Appliance Manufacturer Gross Margins and Markups

	Mfr A	Mfr B	Mfr C	Mfr D
Average Net Revenues (Million)	$372	$280	$4770	$12,682
Corporate Gross Margin	15%	28%	16%	22%
Markup	1.18	1.39	1.19	1.28

Source: SEC 10-K reports (2002-2005)

The average markup value based on these four companies is 1.26.

7.3 RETAILER MARKUP FOR RESIDENTIAL COOKING PRODUCTS

DOE used financial data from the U.S. Census Business Expenditure Survey (BES), in the "Household Appliance Stores" category, to calculate markups used by retailers that apply to residential cooking products.[c 7] Table 7.3.1 shows the BES data that DOE used and the retail markups for these appliances that DOE estimated following the procedures described above.

[c] DOE used the 1997 BES because the 2002 BES did not contain sufficient data for the calculation of gross margin or cost of goods sold.

Table 7.3.1 Data Used to Calculate Retailer Markups for Residential Cooking Products

Item	Million Dollars
Sales (revenue)	10343
Cost of Goods Sold (CGS)	7151
Gross Margin (GM)	3193
Labor-Scaling Costs (LSC)	
Payroll	1366
Fringe Benefits	208
Contract Labor	69
Taxes and License Fees	53
Lease and Rental Payments	238
Telephone and Communications	58
Utilities	70
Repair and Maintenance	36
LCS Subtotal:	2098
Non-Labor-Scaling Costs (NLSC)	
Depreciation and Amortization	94
Office Supplies	37
Packaging and Other Materials	0
Advertising Services	274
Legal Services	8
Accounting, Auditing, and Bookkeeping	19
Computer Related Services	10
Other Operating Expenses	389
Net Profit Before Taxes	263
NLCS Subtotal:	1094
Baseline Markup (MU_{BASE}) = (CGS+GM)/CGS	**1.45**
Incremental Markup (MU_{INCR}) = (CGS+NLSC)/CGS	**1.15**

7.4 SALES TAXES

The sales tax represents state and local sales taxes that are applied to the consumer equipment price of the equipment. The sales tax is a multiplicative factor that increases the consumer equipment price.

DOE derived state and local taxes from data provided by the Sales Tax Clearinghouse.[8] These data represent weighted averages that include county and city rates. DOE then derived population-weighted average tax values for each Census division and large state, as shown in Table 7.4.1 below.

Table 7.4.1 Average Sales Tax Rates by Census Division and Large State

Census Division/State	Tax Rate
New England	4.98%
Mid Atlantic	6.07%
East North Central	6.56%
West North Central	6.65%
South Atlantic	5.95%
East South Central	7.85%
West South Central	8.30%
Mountain	6.46%
Pacific	4.97%
New York State	8.25%
California	7.95%
Texas	7.95%
Florida	6.70%

DOE then derived U.S. average tax values for each product (as shown in Table 7.4.2 below) based on the product's saturation within each Census division and large state. It determined the saturations from the DOE Energy Information Administration (EIA)'s 2001 Residential Energy Consumption Survey.[9] Note that the range of tax rates is relatively narrow—ranging from a low of 6.83 percent for microwave ovens to a high of 7.07 percent for gas non-self-cleaning ovens.

Table 7.4.2 Average Sales Tax Rates by Product

Product	Tax Rate
Electric cooktops	6.70%
Gas cooktops	7.06%
Electric non-self-cleaning ovens	6.74%
Electric self-cleaning ovens	6.64%
Gas non-self-cleaning ovens	7.07%
Gas self-cleaning ovens	6.98%
Microwave ovens	6.83%

7.5 SUMMARY OF MARKUPS

Table 7.5.1 summarizes the markups at each stage in the distribution channel and the overall baseline and incremental markups, as well as sales taxes, for each product.

Table 7.5.1 Summary of Markups

Markup	Baseline	Incremental
Manufacturer	1.26	
Retailer	1.45	1.15
Sales Tax	1.069*	
Overall	1.95	1.55

* Represents average of all seven product classes of cooking products.

The example for microwave ovens, provided below, illustrates how DOE used the baseline and incremental markups to derive a consumer equipment price. Assuming the baseline manufacturer cost is $120 and the change in manufacturer cost to meet a given energy efficiency standard is $10, the resulting baseline consumer equipment price (EQP_{BASE}) and higher-efficiency equipment price (EQP_{STD}) are:

$$EQP_{BASE} = COST_{MFG} \times \left(MU_{MFG} \times MU_{BASE} \times Tax_{SALES}\right)$$
$$= \$120 \times 1.26 \times 1.45 \times 1.069 = \$234$$

$$EQP_{STD} = EQP_{BASE} + \Delta COST_{MFG} \times \left(MU_{MFG} \times MU_{INCR} \times Tax_{SALES}\right)$$
$$= \$234 + \$10 \times 1.26 \times 1.15 \times 1.069 = \$234 + \$15 = \$249$$

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